

LIVER FUNCTION TEST (LFT) CHANGES IN KOSHTASHAKASHRITA AND SHAKASHRITA KAMALA

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Article Received on 05/11/2024

Article Revised on 25/11/2024

Article Accepted on 15/12/2024

ABSTRACT

In *Ayurveda*, Jaundice, known as *Kamala*, is regarded as a disorder primarily affecting the *Raktavahasrotas*, or the channels responsible for the circulation of blood. A key factor contributing to the development of *Kamala* is the vitiation of *Pitta dosha*, which plays a crucial role in its pathogenesis. *Kamala* is often triggered by the frequent consumption of *Ushna* (hot) and *Tikshna* (spicy) foods, which are considered *Pittaprakopaka Ahara*, or food that increases *Pitta* levels in the body. These dietary habits lead to an imbalance that affects the *Pitta dosha*, as well as the *Rakta* (blood) and *Mamsa* (muscle) *dhatu*s, resulting in various physiological disturbances. Clinically, *Kamala* is closely associated with jaundice, sharing several symptoms that are characteristic of this condition. These include a yellowish discoloration of the skin (*Twak pitata*), the sclera of the eyes (*Netra*), urine (*Mutra*), and stool (*Purisha*). To accurately diagnose *Kamala* and its distinguishing features from other liver disorders, comprehensive laboratory investigations are undertaken. Tests such as Liver Function Tests (LFT) and Ultrasound (USG) are vital in identifying different types of *Yakrut vikaras* (liver disorders), including *Kamala*. Among these diagnostic tools, LFT is particularly significant. It not only aids in the accurate diagnosis of the condition but also plays a crucial role in monitoring the effectiveness of ongoing treatment. This article aims to elaborate on the interpretation of LFT changes to facilitate a proper diagnosis and management plan for *Kamala* (Jaundice).

KEYWORDS: *Kamala*, Jaundice, *Pandu*, LFT etc.**INTRODUCTION**

Ayurveda is a science which deals with the study of Knowledge of Life. The aim of this science is to protect the human being from various diseases, which are acquired by not following *Swastha Vritta*. This can be achieved without disturbing the rhythm of your life. The term *Kamala* is derived by the root 'Kamu' which means Kanti suffixing 'Nhin' pratyaya is substituted by Kalaha^[1] thus the term *Kamala* is Kumu + Nhin (Kalaha). *Kamala* is pitta pradhana, raktavaha sroto vikara^[2] where discoloration of the skin, sclera, and nail beds occurs due to the deposition of vitiated pittadosha.^[3] This condition is marked by a diminished hunger and appetite for food. Acharya Charaka has classified *Kamala* as an advanced stage of *Pandu Vyadhi*. In cases where a patient cured of *Pandu* continues to consume *Pitta Vardhaka Ahara*, there is an excessive aggravation of *Pitta Dosha* that leads to *Kamala*.^[4] Acharya Sushruta views *Kamala* as a distinct disease, which may also arise as a complication of *panduroga*.^[5] Meanwhile, Acharya Vagbhata describes *Kamala* as a separate condition⁶, suggesting that it can manifest either as a sequel to

Pandu or independently.^[6] The etiological factors of *Kamala* are extensively detailed in classical texts.

Kamala can be correlated with Jaundice according to their resemblance in signs and symptoms. **Jaundice**, also known as icterus, is a yellowish or greenish pigmentation of the skin and sclera due to high bilirubin levels.^[7] Jaundice in adults is typically a sign indicating the presence of underlying diseases involving abnormal heme metabolism, liver dysfunction, or biliary-tract obstruction.^[8] The prevalence of jaundice in adults is rare, while jaundice in babies is common, with an estimated 80% affected during their first week of life.^[9] The most commonly associated symptoms of jaundice are itchiness, pale faeces, and dark urine which is due to the renal excretion of conjugated bilirubin.

LFT are non-invasive methods for screening, which are an effective modality to detect Hepatic dysfunction. It is most often done to determine the presence of liver disease, the type and pattern of liver disease, to know the extent and progression of liver disease and also done to assess the functional capacity of the liver such as: Its

Synthetic ability and its secretory/excretory abilities. As Jaundice occurs because of hepatic dysfunction LFT plays a vital role in screening the probable pathology leading to disease, severity of liver damage and also to monitor the treatment outcomes by these liver panel tests. Hence, present article focusses to address the lft changes in various types of kamala.

METHODOLOGY

Data will be sourced from esteemed Ayurvedic Samhitas, reputable websites, and peer-reviewed journals to ensure comprehensive coverage.

KAMALA: NIDANA PANCHAKA

Kamala is defined as- 'Kamam kantim harati haridra varnam lati iti kamala' Here, Kamam means desire and kanti is the luster, both are diminished in case of Kamala. Haridra is yellowish discoloration, lati mean runaddati or to get yellowish discoloration, in otherwords, Kamala is a disease in which an individual loses interest in all aspects and gets the yellowish discoloration.^[10] In classics, different terminology is used for the Kamala.

NIDANA: Nidana of koshthashrita Kamala^[11]

1. Aharaja nidana (unwholesome diet) - Excessive intake of amla lavana, katu, kshara, ushna, tikshna (Intake of hot, spicy and junk food, Tila, sarshapa, atasi taila, Pinyaka, Nishpava, Mamsa, Vidagdha anna, Virudha anna, Madya, Kulatha etc.
2. Viharaja nidana (unwholesome regimen) - Ati vyayam (excessive exercise) Atimaithun (excessive coitus), Diwasvapana (sleeping at day time), Vega vidharan (stoppage of natural urge)
3. Manasika nidana (psychological factor) - Kama, Krodha (anger), Chinta (stress), Bhaya (fear), Irshya (jealousy) and Shoka (sorrow).
4. Nidanarthakara Roga (Disease causing diseases) - Pandu Roga (anaemia), Some types of fever i.e. pittaja jwara, vishama jwara, Rakta dhatugata

jwara, paittika gulma, paittika visarpa, Plihodara, Yakritodara and Hridroga etc.

Nidana of shakhashrita Kamala

1. Excessive intake of Ruksha, Sheeta, Guru and Madhura Ahara. (Unwholesome diet).
2. Ati vyayama (excessive exercise).
3. Vega nigraha (stoppage of natural urges).

Samprapti of Kamala: (pathophysiology of Kamala):

When the patient suffering from Pandu Roga indulges in the diet and regimen which cause aggravation of Pitta, the aggravated Pitta Dosh burns the normal Rakta and Mamsa resulting in the disease Kamala.^[12] Here the Vitiated Pitta is vitiating the Rakta dhatu. Due to the equivalent properties of both Rakta and Pitta they get vitiated more. This inturn burn the Mamsa dhatu causing Shithilata. Dushita Pitta mixes up with the Sthanika Pitta leading to yellowish discoloration of Netra, twacha, mutra, nakha etc. Peeta Varna of mootra (urine) and varchas (stools) is due to Increase in malaroopata of Pitta in koshta. His complexion becomes yellowish just like that of the frog of rainy season (Bheka varna), is senses get impaired. The patient suffers from different series of symptoms such as indigestion, burning sensation in the body, anorexia etc. As a result of less nutrition, the patient becomes emaciated and weak.

As in Shakhashrita Kamala, due to excessive intake of shakhashrita nidana sroto sangha of pittavaha srotas occurs. Therefore pitta cannot reach into the koshttha through its normal pathway and the stool is not coloured there due to absence of pitta, so the patient excretes tilpishtha (clay) colored stool. Due to obstruction of srotas, pitta begins to accumulate in liver, from where it is sent to the eyes, skin, nails and buccal cavity etc. for yellow discoloration of these sites.^[13]

POORVAROOPA: Specific Poorvarupa for Kamala have not been mentioned in Brihatrayi or Laghutrayi.

ROOPA

Koshtashakhashrita Kamala(Bahupitta kamala) ^[15]	Shakhashrita Kamala (Alpapitta kamala) ^[16]
Haridra Netra: Yellowing of the sclera	Haridra Netra: Yellowing of the sclera
Haridra twak: Yellowing of the skin	Haridra mutra: Yellowing of the urine
Haridra nakh: Yellowing of the nails	Haridra twak: Yellowing of the skin
Haridra anan: Yellowing of the oral cavity	Shweta varchas- White coloured stools
Rakta-Peeta sakrita mutra: Reddish - Yellow coloured urine and stool	Atopa- Fatulence
Bheka varna: Greenish-yellow tint in the body	Vishtambha- Hardstools
Hatendriya- affected senseorgans	Gurunam hrudayena- Heaviness in chest region
Daha: Sensation of burning in the body	Daurbalya: General weakness
Avipaka: Indigestion	Alpagni- Diminished hunger
Daurbalya: General weakness	Parshwarthi- Pain in flanks
Sadana- Tiredness	Hikka- Hiccups
Aruchi - tastelessness	Shwasa- Difficulty breathing
Karshita- Reduced weight	Aruchi-
	Jwara- Fever

UPASHAYA AND ANUPASHAYA: Nidana parivarjana should be done; koshtashakhashrita kamala patients should not take Pitta aggravating factors. Shakhshrita Kamala patients should not consume Kapha Pitta alleviating factors until the stool of the patient acquires the colour of Pitta.

JAUNDICE: Jaundice is yellowish discoloration of the skin, sclera and mucous membranes due to hyperbilirubinemia and deposition of bile pigments. It is usually detectable clinically, when the plasma bilirubin exceeds 50µmol/L (3mg/dL). Jaundice is not a disease, but rather a sign that can occur in many different diseases.

TYPES/CAUSES^[17]

- HEMOLYTIC JAUNDICE (PRE-HEPATIC)** - It is due to the breakdown of RBCs that leads to increase unconjugated bilirubin level in the blood-but liver function are normal_and the causes are-Abnormal red cells; Antibodies; drugs and toxins, Thalessemia, Hemoglobinopathies, Blood transfusion reaction, Gall bladder stone, Gilbert's, Crigler-Najjar syndrome etc.
- HEPATOCELLULAR JAUNDICE (INTRAHEPATIC):** It is due to dysfunctioning of the liver cells_and the causes are - Infection (Viral hepatitis), Drug or chemical toxicity (Toxic hepatitis), Excessive alcohol consumption, Intrahepatic cholestasis etc.
- OBSTRUCTIVE JAUNDICE (POST HEPATIC)** - It is due to obstruction of the bile duct that leads to altered secretion of bile and is of two types. Extra hepatic obstructive jaundice- occurs due to blockage in the bile duct ex: Gall stone, Tumour, Cholestasis of the bile duct, Carcinoma of pancreas. Intra

hepatic cholestatis: It occurs due to blockage or swelling in intra hepatic duct.

CLINICAL MANIFESTATION

- Yellowish skin and sclera
- Light grey or clay coloured (alcoholic) stool
- Itchy skin
- Nausea
- Lack of appetite
- Dark coloured urine
- Prothrombin time increase

DIAGNOSTIC EVALUATION

Liver Function Tests^[18]

Liver Function Tests (LFTs) represent a vital diagnostic toolkit for evaluating the liver's intricate physiological processes, ensuring timely detection of liver dysfunction and guiding targeted therapeutic interventions. This suite of laboratory tests systematically assesses key enzymes, proteins and biochemical markers to gauge the liver's metabolic, excretory and detoxification capacities. By analyzing these parameters, it enables to identify subtle abnormalities, diagnose liver diseases such as hepatitis, cirrhosis and liver cancer, and monitor the progression of liver damage. Ultimately, LFTs play a pivotal role in maintaining liver health, preventing complications and optimizing treatment outcomes for individuals with liver-related disorders.

INDICATIONS OF LFT

1. Jaundice
2. Suspected Liver Metastasis
3. Any undiagnosed chronic illness
4. ALD
5. Coagulation Diseases
6. Therapy with statins to Check hepatotoxicity

LFT PARAMETERS	CHANGES	CAUSES
Unconjugated bilirubin	Increased	Abnormal red cells, antibodies; drugs and toxins, Thalessemia, Hemoglobinopathies, Gilbert's, Crigler-Najjar syndrome
Conjugated bilirubin	Increased	Extrahepatic cholestasis; gallstones; tumors of the bile duct, carcinoma of pancreas
Unconjugated & conjugated	Increased	Viral hepatitis, toxic hepatitis, intrahepatic cholestasis
Serum albumin	Decreased	Reduced essential amino acids in diet and reduced synthesis of non-essential aminoacids, Malnutrition Malabsorption.
	Increased	Surgery ,Trauma, Infections, Defective synthesis in liver in Chronic liver diseases
Serum globulin	Increased	Cirrhosis, Chronic active hepatitis, multiple myeloma or autoimmune diseases
Albumin: globulin ratio	Decreased	Overproduction of globulins, or Underproduction of albumin or Selective loss of albumin from the circulation
	Increased	Underproduction of immunoglobulins may be seen in some genetic deficiencies and in some leukemias.
Prothrombin	Prolonged	Vitamin K Deficiency, Liver disorder.
Alanine transaminase (ALT/SGPT)	Increased	Hepatocyte injury, hepatocellular necrosis.
Aspartate transaminase (AST/SGOT)	Increased	Liver diseases, Myocardial infarction, Progressive skeletal muscular dystrophy, Crush Injury, Hemolytic disease etc.
Gamma glutamyl	Increased	Biliary obstruction; Viral, toxic & alcoholic hepatitis; Primary

transferase(GGT)		and secondary liver tumors.
Alkaline Phosphatase	Increased	Bone causes - Tumors (osteogenic), Paget's disease of bone, Primary osteogenic tumors, Healing of bone fractures etc. and Hepatobiliary tract causes - Obstructive jaundice (intrahepatic or extrahepatic) & Viral, toxic & alcoholic hepatitis.

DISCUSSION

In the realm of Ayurvedic literature, kamala is unequivocally recognized as a condition arising from a pitta dosha imbalance, often referred to as pittaja nantmaja. The esteemed Acharya Charaka asserts that kamala represents an advanced stage of pandu roga, commonly associated with anemia. In contrast, Acharya Sushruta effectively highlights kamala as both a complication of pandu roga and a potential consequence of various other diseases. Additionally, Acharya Vaghata confidently designates kamala as a distinct disease worthy of its own classification. Nidanans include various pittavardhaka ahara along with various manasika and nidanarthakara rogas as previously mentioned.

The signs and symptoms of kamala are strikingly similar to those of jaundice, underscoring a clear relationship between these two conditions in Ayurvedic medicine. Kamala is classified based on its origin and the underlying pathology involved, and it is categorized into two primary types: koshtashakhashrita kamala and shakhashrita kamala. This comprehensive understanding

of kamala not only enhances our appreciation of its complexity but also reinforces its significance within Ayurvedic healing practices.

Koshtashakhashrita kamala can be correlated to Pre-hepatic jaundice. As previously mentioned, this occurs due to dagdha of rakta and mamsa because of indulging in pitta prakopakara ahara by pandu rogi. It is also called Bahupitta kamala. Similarly in Prehepatic jaundice condition occurs due to excessive breakdown of RBS's either due to Intrinsic (Hereditary) or Extrinsic (Acquired) causes. Intrinsic causes include Hereditary Spherocytosis, GHPD Deficiencies, Hemoglobinopathies like Thalassemia, Sickle cell Anaemia etc. Whereas Extrinsic causes include-Incompatible blood transfusion, Auto immune disorders, Malaria etc. Here symptoms produced are Haridra Netra-twak-nakh-anana (Yellowing of the sclera-skin- nails-oral cavity), Rakta-Peeta sakrita mutra (Reddish - Yellow coloured urine and stool), Bheka varna (Greenish-yellow tint in the body), Avipaka (Indigestion), Daurbalya (General weakness) etc.

LFT Changes includes

Unconjugated bilirubin	Increased than Conjugated bilirubin
ALT, ALP	Normal
AST	Normal or mild to moderately increased
Total Protein	Normal
Total Albumin	Normal
Total Globulin	Normal
A/G ratio	Normal

Shakashrita kamala also called Alpapitta kamala occurs due to margavarodha by vriddha kapha, making further vitiation of vata dosha, which later takes pitta towards shaka producing peetavarna of tvak,- netra - nakha - mutra but as pitta is not available within koshta, mala formed is of shweta varna. This is similarly seen in case of Obstructive jaundice where there will be obstruction to the movement of bile in extrahepatic duct resulted either due to Extrahepatic or Intrahepatic obstructive conditions priorly mentioned above. This stagnation of

bile damages the hepatocytes and also there will be increased level of conjugated bilirubin in serum and decreased excretion into bile ductules or backward leakage of pigment. The colour of urine is dark yellow because of increased conjugated bilirubin (water soluble) in urine. Symptoms produced here are-Haridra Netra-mutra-twak: Yellowing of the sclera - urine - skin, Shweta varchas - White coloured stools, atopa - fatulence, vishtambha - hardstools, gurunam hrudayena - heaviness in chest region, aruchi, Jwara - fever etc.

LFT Changes includes

Serum Conjugated Bilirubin	Increased
AST,ALT	Normal to moderately Increased
ALP and GGT	Increased several times

NOTE - If ALP > 1,000 OR > 6 times the normal – Infiltrative disease of liver

In Hepatocellular jaundice, when there is complete obstruction of all the bile canaliculi due to their compression by oedematous hepatocytes, jaundice is produced just like shakhashrita Kamala. When there is

incomplete obstruction or when all the bile canaliculi are not obstructed then it is produced like that of koshtashrita Kamala. Therefore the mechanism of Hepatocellular jaundice can be compared to koshtashrita Kamala or shakhashrita Kamala in

different individuals depending upon the severity of the disease.

CONCLUSION

- Kamala is a pitta pradhana, raktavaha sroto vikara.
- It is mainly of two types koshtashkhashrita kamala and shkhashrita kamala.
- In liver function tests, elevated serum bilirubin levels (unconjugated hyperbilirubinemia) are primarily associated with conditions such as Koshta shkhashrita Kamala (Bahu Pitta Kaala).
- Serum bilirubin can be interpreted as Malaroopi Pitta, which is more prevalent in circumstances like hemolytic jaundice, where significant damage occurs to the blood components (Rakta dhatu).
- Aspartate aminotransferase (AST; SGOT) and alanine aminotransferase (ALT; SGPT) are sensitive indicators of liver cell injury, with ALT serving as a more specific measure of liver damage; ethanol-induced liver injury typically leads to moderate increases in these enzymes, often showing a more pronounced elevation in AST compared to ALT. Both of these enzymes can be regarded as primarily consisting of Tejo mahabhuta according to Ayurvedic principles, and their elevated levels indicate Agnidushti and Pitta vrudhi.
- Alkaline phosphatase is a sensitive marker for cholestasis, biliary obstruction (with enzyme levels rising more rapidly than serum bilirubin), and liver infiltration, exhibiting mild elevations in various other liver diseases. Consequently, the increased values may point to the possibility of Shkhashrita Kamala or Alpa-Pitta Kamala. In stool examinations, a whitish, bulky stool resembling Tilapishtanibha varchas is typically observed.
- As Kamala is purely a paittika roga. The line of treatment of kamala roga, should mainly be pittahara chikitsa (virechana).

REFERENCE

1. Kumar G, Shabda Kalpadruma, Varanasi: Chaukhambha Surbharati prakashana; UP; 2008.
2. Acharya YT Agnivesha. Charaka samhita, redacted by Charaka and Dr idhabala with Ayurveda Dipika commentary by Sri Chakrapanidatta, Varanasi: Chaukhambha Surbharati prakashana; UP; 2009.
3. Acharya YT, Agnivesha. Charaka samhita, redacted by Charaka and Dr idhabala with Ayurveda dipika Commentary by Sri Chakrapanidatta, Varanasi: Chaukhambha Surbharati prakashana; UP; 2009.
4. Agnivesha, Charaka Samhita, Chikitsa Sthana, Chapter 16, verse 40, Ayurveda deepika commentary by Chakrapanidatta. Editor: Yadavaji Trikamaji Acharya. Chaukhamba Surabharati Prakashana Varanasi. Edition, 2016; 530.
5. Sushruta, Sushruta Samhita, Uttara tantra, Chapter 44, verse 10, Nibandha sangraha Commentary by Dalhanacharya, Edited by, Vaidya Yadavji Trikamaji Acharya, Chaukhambha Orientalia, Varanasi, Edition, 2014; 729.
6. Vagbhata, Ashtanga Hridaya, Nidana sthana chapter 13. Verse 17 Sarvanga sundara and Ayurveda rasayani commentary of Arunadatta and Hemadri. Pandit Hari Sadashiv Sastri Paradkar, Chaukhambha Surabharati Prakashan. Varanasi. Edition, 2016; 519.
7. Buttaro TM, Trybulski JA, Polgar-Bailey P, Sandberg-Cook J (2012). Primary Care: A Collaborative Practice (4th Ed.). Elsevier Health Sciences. p. 690. ISBN 978-0-323-07585-5. Archived from the original on, 8 September 2017.
8. Al-Tubaikh JA (2017). Internal Medicine. Doi: 10.1007/978-3-319-39747-4. ISBN 978-3-319-39746-7.
9. Kaplan M, Hammerman C (2017). "Hereditary Contribution to Neonatal Hyperbilirubinemia". Fetal and Neonatal Physiology. Elsevier: 933–942.e3. doi:10.1016/b978-0-323-35214-7.00097-4. ISBN 978-0-323-35214-7.
10. Raja Radhakantadev Bahaddur. Shabdakalpadruma volume- 4, Naga Publication. Delhi. Edition, 1987; 4: 60.
11. Charaka Samhita of Agnivesha elaborated Vidyotini hindi commentary, Pt. Kashinath Shastri & Dr. Gorakha Natha Chaturvedi, Part 2, Chikitsa Sthan; 16/7-9; Chaukhambha Bharti Academy, Varanasi, Reprint, 2013; 488.
12. Vaidya Yadavaji Trikamaji Acharya, Charaka Samhita, Chakrapani Tika, Reprint, 2013; 528-532.
13. Vaidya Yadavaji Trikamaji Acharya, Charaka Samhita, Chakrapani Tika, Reprint, 2013; 528.
14. Astangahridayam of chaukhambha sanskrit sansthan varanasi 13th edition, 2000; edited with the vidyotini hindi commentary by kaviraja atrideva gupta nidana sthana chapter1/4; 216.
15. Charaka Samhita of Agnivesha elaborated Vidyotini Hindi commentary, Pt. Kashinath Shastri & Dr. Gorakha Natha Chaturvedi, Part 2, Chikitsa Sthan; 16/35- 36; Chaukhambha Bharti Academy, Varanasi, Reprint, 2013; 492.
16. Charaka Samhita of Agnivesha elaborated Vidyotini Hindi commentary, Pt. Kashinath Shastri & Dr. Gorakha Natyha Chaturvedi, Part 2, Chikitsa Sthan; 16/127-128; Chaukhambha Bharti Academy, Varanasi, Reprint, 2013; 506.
17. Joseph A, Samant H. Jaundice. [Updated 2023 Aug 8]. In: StatPearls [Internet]. Treasure Island (FL): Stat Pearls Publishing; 2024 Jan; Available from: <https://www.ncbi.nlm.nih.gov/books/NBK544252/>.
18. Naveen Chandra N.H, Textbook on Clinical Biochemistry and Haematology With Clinical Concepts, 1st ed, Naveen Chandra N.H; 2015; Chapter 8, 163.